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The Cleveland Convention Papers—II

The Convention programme was heavily loaded with Papers on malleable cast iron, and probably for the first time exceeded in numbers those dealing with cast iron. A contribution of major importance was made by Dr. H. A. Schwartz (E. J. Fox Medallist), who has in "The Principles of Graphitisation" reviewed the various factors to be considered when graphitising white iron to produce malleable blackheart iron. A question much in the limelight at the moment is that of annealing furnace atmosphere, and in this connection Dr. Schwartz remarked that "It is quite certain that the presence of mixtures of CO_2 and CO accelerates annealing, and it is reasonably certain that under high pressures this is not true below the critical point. This question of gases is taken up closely by Mr. C. H. Lorig and Mr. M. L. Samuels in a Paper on "Some Effects of Hydrogen on the Time of Malleablisation." These investigators bubbled hydrogen through the liquid metal and gave cast samples, both treated and untreated, preliminary heat-treatments between 300 and 700 deg. C. at 50 deg. C. intervals, with the object of driving out the hydrogen. The authors drew the following conclusions: (1) White cast iron, especially that in the quick anneal range of compositions, responds to both first- and second-stage malleablisation at a much faster rate after having been given a pretreatment in the neighbourhood of 300 deg. C. (2) Melts supersaturated with hydrogen are even more responsive to this pretreatment than those normally produced. (3) Faster malleablisation may be explained by the presence of a greater number of temper carbon nodules in the pretreated irons than in those annealed directly in the as-cast condition. (4) Smaller temper carbon nodules evidently originate from a nuclearisation effect of the low-temperature pretreatment. (5) Nuclearisation is apparently associated with the escape of hydrogen, but the exact mechanism is still unknown. A third Paper devoted to this subject of the effect of atmosphere during the annealing of blackheart malleable is from Mr. R. J. Cowan, entitled "Atmospheres and the Annealing of the Malleable Iron." It is especially interesting, as it deals with the installation of plant for the production of gases of various kinds alongside the malleablising furnace. Thus the American metallurgist so equipped has the choice of introducing virtually pure nitrogen, heavily ladened CO, or 75:25 mixture of hydrogen and nitrogen, and so on. A Paper of practical importance was presented by Mr. F. E. Reeves, of Saginaw, on "Gating Malleable and ArmaSteel Castings." Very extensive use is made of blind-riser shrink bobs to prevent shrinkage cracks in the castings, whilst the choking of runners is practised for curing troubles arising from the entry of slag into the castings. Another successful method detailed is the use of gate skim cores, much after the pattern of a teapot ladle. The Paper finishes by listing nineteen questions which form the daily routine examination to be performed by the foundry foreman. Everybody realises that there is a difference in the temperature of the oven and the pot during annealing, but how many realise that there is a corresponding difference between the hours "to temperature" and "at temperature" because of this lag? In his Paper on "The Temperature Control of Graphitising Furnaces," Mr. J. H. Lansing has reproduced the two curves on one graph which clearly brings out these points. A neat piece of research work, which justifies further elaboration, has been detailed by Mr. W. D. McMillan in his Paper on "The Effect of Composition on the Annealing of White Cast Iron." For the first stage graphitisation an iron with 0.89 per cent. silicon required 24 hours for completion, as against 3 hours for one containing 1.79 per cent. silicon,

(*Continued overleaf.*)

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THE CLEVELAND CONVENTION—II

(*Continued from previous page.*)

these two irons being the extremes of a range of eleven tested. The higher silicon irons also yielded a very much higher number of carbon nodules per standard field. Those who are interested in quick anneal malleable, the development of which has made greater strides in America than most of us realise, will derive a better concept of the position by studying a Paper by Mr. D. P. Forbes, the President of the Gunite Foundries Corporation. He deals with the two major commercialised processes, and indicates the underlying metallurgical changes which take place. In this Paper, which up to now we have called ArmaSteel, becomes ArMa Steel! The author concludes his Paper with a description of the heat-treating equipment used, a subject dealt with in considerable detail by three other authors. Mr. W. R. Bean, a Past-President of the A.F.A., in association with Mr. W. R. Jaeschke, covers the question of "Periodic Malleable Annealing Furnaces"; Mr. R. J. Anderson, in his Paper, deals with the Dressler or Tunnel-type kiln, and takes cognisance of the effect on costs when production fails to reach furnace capacity; and finally Mr. R. M. Cherry, of the American G.E.C., details the latest advances which have been made in the field of electrically heated furnaces. There are claims in this Paper, such as the use of thinner pots, which are interesting pointers. These dozen or so Papers, none of which is highly theoretical, comprise a most valuable contribution to the study of malleable, and show how America is leading the field in this particular branch of foundry work.

Corrosion of Copper and Brass.—From electrochemical and chemical studies of the corrosion of copper and alpha brass by J. H. HOLLOMON and J. WULFF, reported in Tech. Pub. No. 1458 of the American Institute of Mining and Metallurgical Engineers, and reprinted in "Metals Technology," the authors conclude that the corrosion of alpha brass occurs by the solution of the alloy as an entity. Dezincification occurs by reduction of the cupric ion to cuprous ion followed by the reduction of the latter ion to metallic copper. During corrosion of arsenical brass, the arsenic enters solution as the trivalent ion and subsequently redeposits upon the brass surface. The arsenical film increases the effective potential practically to that of copper and prevents the deposition of copper. The beneficial effect of antimony and phosphorus may be explained analogously to that of arsenic, for films are formed during the corrosion of alpha brasses containing both of these elements. This explanation does not require an anode film as postulated by Fink and Evans, nor does it affirm Masing's point of view that the inhibition is due to the lowered hydrogen overvoltage.

PATTERNMAKING WRINKLES—III

By "CHIP"

The importance of keeping edge tools sharp cannot be too often stressed to young patternmakers. Many years ago the writer was told by an old craftsman, "the secret of good patternmaking lies in the use of sharp tools." Whilst the introduction of sanders and similar labour-saving devices has reduced the necessity for much of the work previously prepared by hand-tools, the saying is still true, for even now much work has to be finished by hand. Chisels and gouges are amongst the most important of the patternmaker's hand-tools, and must be constantly kept sharp by rubbing on an oilstone and buffing by a piece of

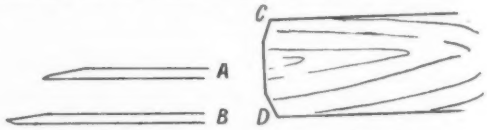


FIG 1.

FIG 2.

leather sprinkled with fine emery powder. A mistake often made by the novice is to tilt the chisel slightly when rubbing off the "burr" from the back, with the consequent alteration of the cutting edge—A in Fig. 1 being correct, whilst B is wrong. Here it might be stressed that the oilstone should be periodically trued to obtain the best results. Using a chisel or gouge sharpened as B results in the tool digging into the work, thus making it impossible to cut the piece square. Before paring with a chisel the desired shape should be marked on both sides of the piece and then trimmed down as is shown in Fig. 2. A blacklead line should then be traced around the edges C and D, and the chisel used to remove the intervening timber; care being taken to preserve the blacklead lines, which should only be removed during the subsequent operation of glasspapering.

Counting Non-Metallic Inclusions.—A method for counting the number of non-metallic inclusions in steel is outlined by S. I. ALISSANOWA in "Sawod. Labor." In another article in the same journal, I. E. BRAININ and T. BRUSCHTSCHENKO describe the characteristic appearance of the various classes of inclusions and the changes wrought by various etchants.

Cleaning Aluminium Alloy Core Shell-Carriers.—A tip given in "The Foundry" tells how to remove the carbonaceous deposit from core carriers. This is effected by immersing the carrier for a few moments in a solution made up of one part of liquid silicate to 30 parts of water. For those made of iron and steel a granulated silicate is recommended.

Inspection Lamp for Inflammable Situations.—The G.E.C. have designed and placed on the market a low voltage hand-lamp and a combined transformer and switch unit, well suited for the examination of cylinders and vats that contain or have contained materials likely to yield inflammable gases.

ARMASTEEL—ITS MANUFACTURE, CONTROL AND APPLICATIONS

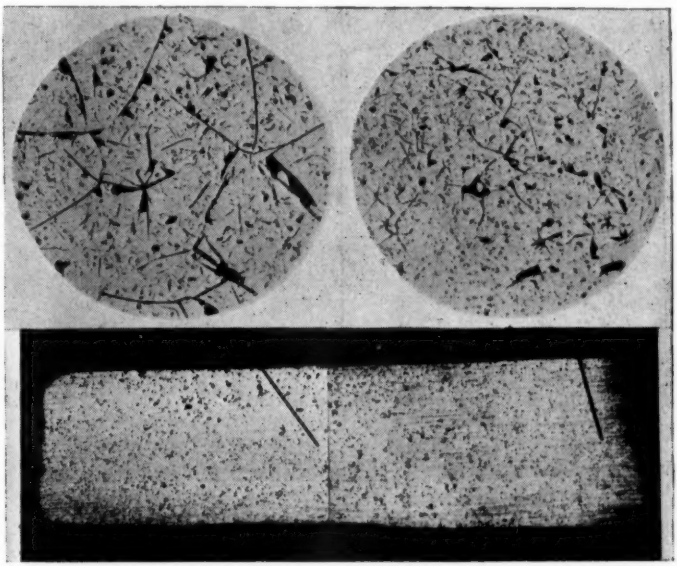
A.F.A. Exchange Paper read at June Annual Conference of The Institute of British Foundrymen

By CARL F. JOSEPH

(*Continued from page* 369.)

Personnel Angle

The personnel angle enters into the control of any product, and in particular in the development of a new product which is expanding its field to cover and replace a material which in the past has given satisfactory service. Also, when replacing forgings, it must be remembered that many years, undoubtedly, were spent on certain parts before the present high quality was obtained, and to overcome this handicap the training of personnel to produce a new product is of major importance. There are two ways this problem must be approached—one is to continue to train personnel along technical lines in the development of an attitude of responsibility and teamwork throughout the organisation—and the other is in research of the basic principles underlying the metallurgical aspects of iron-making methods, including new aids in the control of the process and new kinds of equipment needed to do a better job. "Just good enough to pass" is no longer the attitude to take. "As good as possible" is what must be drilled into the workmen and foremen alike. To strive for higher quality will produce results both in increased business and lowering of costs. Arma-Steel must receive the attention of that given to quality material. It must be processed in smaller batches to insure uniformity and exactness of control.



FIGS. 21, 22 AND 23.—10 PER CENT. SI PIG-IRON, CAST IN OLD STEEL MOULD, LIMEWASHED, SHOWING STRUCTURE AT CENTRE OF PIG (TOP LEFT) AND NEAR BOTTOM SURFACE (TOP RIGHT), BOTH UNETCHED, × 100. FIG. 23 (BELOW), UNETCHED, × 3, SHOWS SURFACE FINE GROUND, BUT NOT POLISHED.

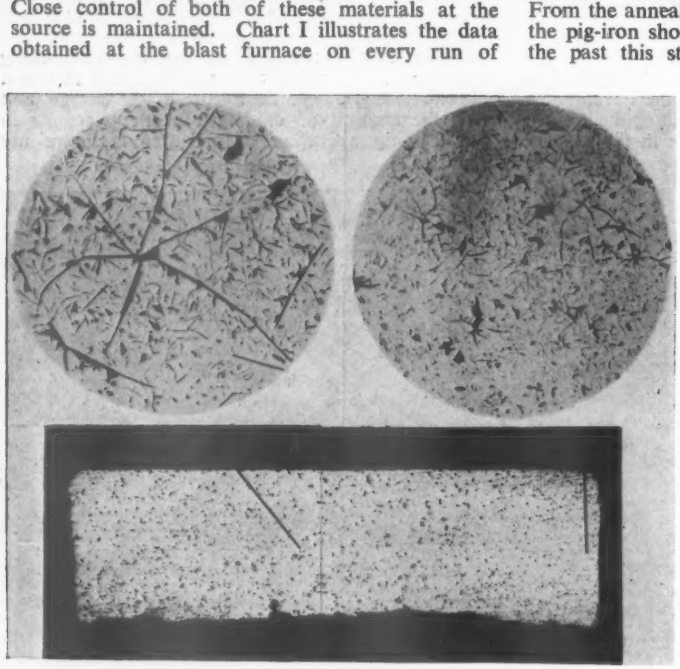
Melting Equipment and Procedure

The melting equipment used by various manufacturers in the production of sorbitic or graphitic steels is not as important as the raw materials going into the charge. It is true that the chemical composition of the metal from the various melting processes will show a wide variance, but this to a great extent is due to the nature of the charge used and the amount of oxidation of the elements in the melting operation. Most manufacturers use pig-iron and steel in the charge. Those using the duplex process use cupolas as the melting medium, and coke plays an important role in the successful operation of the cupola.

Pig-iron

At the Saginaw plant silvery pig-iron and coke are two of the principal raw materials affecting the

properties of the product, and both are carefully controlled. Heredity is common to both pig-iron and coke, and many bad experiences in the past have been traced directly to these two materials. Close control of both of these materials at the source is maintained. Chart I illustrates the data obtained at the blast furnace on every run of silvery pig-iron. No changes in blast furnace raw materials or operations are made without consulting the foundry. Naturally chemical composition must be relied upon in making up the cupola charge, but is only a means of control in the successful operation of the cupola, and offers very little in the way of solving the many metal troubles experienced in the foundry. Even with close chemical control in the foundry, there are chances for variation in the finished product which can often be traced back to the ores or fuel used in the blast furnace burden or the blast furnace practice. In general, the pig-iron producer has no difficulty in meeting chemical specifications for carbon, silicon, manganese, sulphur and phosphorus. Even alloys are absent to a degree which might cause any trouble. Microscopic examination of the pig-iron is a routine test of the greatest importance. From the annealability angle, the microstructure of the pig-iron should reveal little or no steadite. In the past this structure has definitely shown that the iron will anneal with difficulty when large amounts of steadite are present.*



FIGS. 24, 25 AND 26.—10 PER CENT. SI PIG-IRON, CAST IN NEW STEEI MOULD, LIMEWASHED, SHOWING STRUCTURE AT CENTRE OF PIG (TOP LEFT) AND NEAR BOTTOM SURFACE (TOP RIGHT), BOTH UNETCHED, × 100. FIG. 26 (BELOW), UNETCHED, × 3, SHOWS SURFACE FINE GROUND, BUT NOT POLISHED.

The accompanying micrographs, Figs. 6 and 7, show the amount of steadite present in good and troublesome pig-iron. Steadite in even small amounts is undesirable in pig-iron to produce castings for short-cycle malleablising.

Graphite Size as Influenced by Pig-iron

Graphite size in the pig-iron has a marked influence on the properties of the resultant castings. Since ArmaSteel parts in many cases are highly polished, it is extremely important that the castings have small temper-carbon spots. Large carbon spots adversely affect the machinability. Therefore, in order to produce the most satisfactory castings as regards surface finish and machinability, a study of the graphite size in pig-iron is of utmost importance, as it directly affects the carbon spots of the casting. As mentioned before, ores, coke and blast-furnace practice affect the properties of the pig-iron, and this is particularly true regarding size of graphite in pig-iron. Figs. 8 and 9 represent small and medium graphite flakes respectively in two different pigs (micrographs taken from centre of pig). Figs. 10 and 11 represent ArmaSteel produced from pig-iron in Figs. 8 and 9 respectively, tempered to a Brinell of 207. Figs. 12 and 13 represent ArmaSteel produced from pig-iron in Figs. 8 and 9 respectively, tempered to

* A.F.A. Transactions. Vol. 40, 1932. High-Silicon Pig-Iron for Malleable Manufacture. A. L. Boegehold—Carl F. Joseph.

a Brinell of 170. Note the large variation in size of the temper carbon in the ArmaSteel produced by each of the two pig-irons of like chemical analysis. Large graphite in the pig-iron is carried through the melting operation to the malleablised structure of the annealed casting.

Pig-iron Casting Practice v. Graphite Size

The following micrographs indicate the effect on rate of cooling of the pig-iron through and after solidifying in the mould (all micrographs were taken from centre of pig × 100). Fig. 14 is from the first portion of the cast completely cooled through the water spray; Fig. 15, the last portion of the cast completely cooled through the water spray; Fig. 16, from the middle of the cast removed when half-way through the cooling spray; and Fig. 17, from the middle of the cast, air-cooled. The last two micrographs show larger graphite flakes. There is a definite tendency to coarsen the primary graphite on more slowly cooling through the solidification range. The rate of cooling after solidification has no effect on the coarseness of the graphite. Some work has been done to determine the effect of graphite size in pig-iron produced by casting metal into both copper and steel moulds

Figs. 18, 19 and 20 show pig-iron cast in a copper mould, using no lime wash; Figs. 21, 22 and 23 show pig-iron cast in an old steel mould, using

CHART NO. 1.

QUALITY OF IRON AS AFFECTED BY BLAST FURNACE PRACTICE: PIG IRON—BLAST FURNACE DATA.

1.—Furnace No. ..... Location .....

2.—Superintendent ..... Date Produced .....

3.—Composition of Ores:

Name—					
Fe	.....	.....	.....	.....	.....
P	.....	.....	.....	.....	.....
SiO_2	.....	.....	.....	.....	.....
Al_2O_3	.....	.....	.....	.....	.....
CaO	.....	.....	.....	.....	.....
MgO	.....	.....	.....	.....	.....
Mn	.....	.....	.....	.....	.....
Per cent.	.....	.....	.....	.....	.....
Pounds	.....	.....	.....	.....	.....

4.—Coke Charge .....lb. Coal Charge .....lb.

5.—Rounds per day .....

6.—Kinds of Coke— Analysis—

1. Shatter Test ..... Fixed Carbon .....
2. True Sp. Gr. ..... Vol. Hydrocarbons.. .....
3. App. Sp. Gr. ..... Ash .....
4. Porosity..... Sulphur .....
Water .....

7.—Burning Characteristics of Coke:

1. Av. Temp. Rise .....
2. Av. Time for 250° Temp. Rise .....
3. Ignition Temp. .....

8.—Kind of Coal ..... Analysis—

Fixed Carbon .....
Vol. Hydrocarbons .....
Ash .....
Sulphur .....
Water .....

9.—Limestone Source .....

Analysis—

$CaCO_3$ ..... CaO .....
$MgCO_3$ ..... MgO.....
Oxide .....
SiO_2.....
.....

Lbs. of limestone per round .....
Lbs. of limestone per ton.....

(*Chart continued overleaf.*)

ArmaSteel—Its Manufacture, etc.

lime wash; Figs. 24, 25 and 26 show pig-iron cast into a new steel mould, using lime wash; and Fig. 27 is a photograph of polished sections of high-silicon pig-iron cast in an uncoated copper mould and in a coated steel mould. The fact that pig-iron cast in a copper mould shows a sounder iron, in which the graphite flakes are much finer than the same iron poured into a steel mould, is an indication of better casting practice, and is a step in the right direction. The casting of smaller and thinner pigs produces a somewhat finer graphite size.

Figs. 28 and 29 show near the surface and centre of a 38- to 42-lb. pig, which represents a better graphite size than that of a heavier pig. The pig-iron producer will be called upon more and more in the future to help the foundryman solve some of his troubles, and graphite size of pig-iron is only one of them.

Coke

In the duplex process, in which the cupola is used as the melting medium, coke plays a major rôle in the production of high quality metal. Many foundrymen prefer poor melting stock to poor coke. That only proves that good coke is almost a necessity in the successful operation of the cupola. In

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CHART NO. 1—*continued.*

10.—Blast Temp. ..... Max. ..... Min. ..... Cycle .....

11.—Blast Pressure ..... Av. /sq. in. ..... Max. ..... Min. .....

12.—Air per minute ..... cub. ft. ..... lb.

13.—Fuel burned per hour ..... lb. ..... /sq. in. area at max. dia. .....

14.—Pounds of air per pound of fuel ..... Air per lb. of carbon .....

15.—Blast velocity through tuyeres ..... ft. per min.

16.—Composition of top gases ..... per cent. CO ..... per cent. CO_2 .....per cent. H ..... per cent. H***

17.—Temp. of top gases .....

18.—Burden per hour. ..... lb. ..... /sq. ft. area at max. dia. .....

19.—Composition of slag ..... (flushing slag)
SiO_2 ....
Al_2O_3 .... Appearance of slag .....

20.—Weight of iron produced per hour ..... lb.
Weight per sq. ft. area at max. dia. per hour ..... lb.

21.—Depth of metal in hearth at tapping ..... ft.

22.—Casting Temp. ..... max.
..... min.
..... Av.

23.—Time between casts ..... hrs.

24.—Dimensions of furnace:
1. Stock line to tuyeres ..... ft. ..... in.
2. Tuyere level to hearth ..... ft. ..... in.
3. Size and number of tuyeres .....
4. Iron notch to cinder notch ..... ft. ..... in.
5. Dia. of hearth ..... ft. ..... in.
6. Dia. at top of both ..... ft. ..... in.
7. Cubical contents of furnace ..... cub. ft.

25.—Number of stoves ..... In use ..... heating up .....

26.—Chemical Analysis:

Average of Five Pigs.

T.C	C.C	Si	Mn	S	P
.....	.....	.....	.....	.....	.....

27.—Atmospheric temperature, deg. F. ..... max.
..... min.
..... Av.

28.—Barometric pressure ..... in. Hg

29.—Humidity .... Grs. per cub. ft.

the classification of coke, the author likes to refer to "slow" and "fast" burning coke. The method of determination of burning rates is described in A.F.A. Transactions.*

Northern cokes, produced from coals mined in the northern part of the United States, are fast burning, and produce higher carbon metal at the cupola spout, usually at a lower temperature than that obtained from southern coke, produced from coals mined in and around the State of Alabama, which is slow burning and produces a low carbon metal. Regardless of the coke source, it is desirable to have uniform sized coke, free from green ends and porosity. There is some question among foundrymen regarding the size of coke. Some prefer large chunks (6 to 8 in. across) others like small pieces (2 to 3 in. across). The diameter of the cupola has considerable bearing on the most desirable size. In the operation of an 8 ft. 6 in. diameter cupola, coke the size of two fists (about 4 to 5 in. across) is giving satisfactory results.

Many bad experiences in the past in maintaining close carbon control on cupola metal has prompted much investigation on the major sources of carbon, which is coke. The metallurgical coke used in the production of low carbon cupola metal performs two functions. First, it supplies the heat to melt the iron and steel charge, and secondly, it carburises the charge, raising the carbon from an average of 1.40 per cent. to 2.60 per cent. To maintain the molten metal to within the desired 10 point range, one

(*Continued on p.* 397.)

* A.F.A. Transactions. Vol. 37, 1929. Quality of Pig-Iron and Castings as Affected by Blast Furnace Practice. A. L. Boegehold.

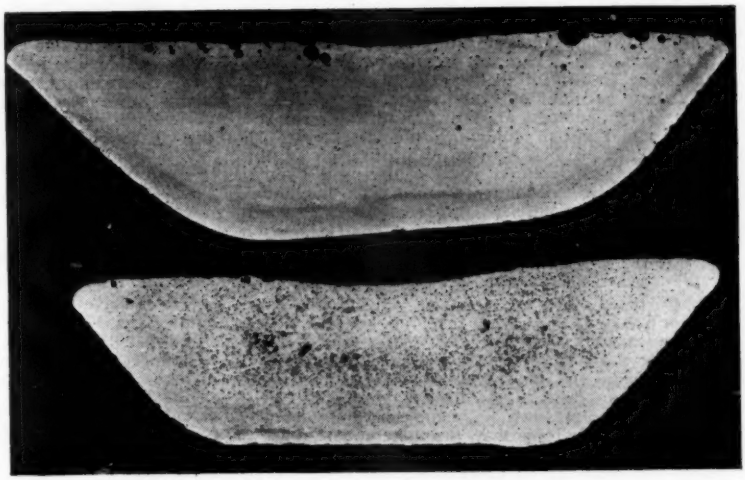

FIG. 27.—PHOTOGRAPHS OF POLISHED SECTIONS OF 10 PER CENT. Si PIG-IRON, CAST IN UNCOATED COPPER MOULD (ABOVE) AND CAST IN COATED STEEL MOULD (BELOW).

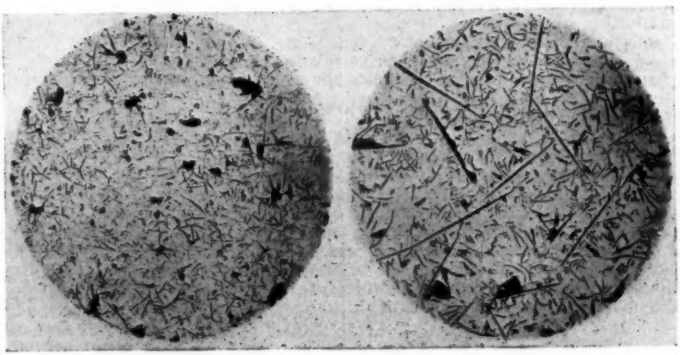

FIG. 28. FIG. 29.

FIGS. 28 AND 29.—10 PER CENT. Si PIG-IRON, SHOWING SECTIONS OF CHILL CAST IRON, AIR-COOLED, ¼ IN. FROM SURFACE OF MOULD ON LEFT AND AT CENTRE OF PIG ON RIGHT, BOTH UNETCHED, × 100.

CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

"Blast Control in the Foundry Cupola"

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—The article of S. A. Herres and C. H. Lorig should prove of inestimable value to the up-to-date foundry man, but more particularly to the foundry engaged on repetition casting of small parts.

But, as far as I can see, it will be necessary to make some adjustment to the calculations before the information becomes of real use, for the following reason:—The authors appear to have overlooked certain conditions in compiling the chart (Fig. 1). That volume varies, as they say, directly as the pressure and temperature, is of course well known, but to state that the volume as read by a differential flow gauge can be adjusted in accordance with chart (Fig. 1) ignores another well known law, viz.:—

$$V = \sqrt{\frac{2.P}{\rho.T}} \text{ where } \rho = \text{density of the air.}$$

In differential flow measurement, whether by pitot tube, orifice disc, or venturi tube, the volume varies as the square root of the differential. The differential itself is dependent on the kinetic energy of the flowing air, and therefore on the density of the air. Then, because the density is directly proportional to the pressure and temperature (those two laws again!) it follows that the differential gauge's reading of volume must be proportional to the square root of the pressure and temperature.

In other words, the authors appear to me to have overlooked the fact that the volume of air as indicated by the gauge was subject to these pressure and temperature changes from some standard during the actual process of measurement; and the volume as read has therefore already been subject to some automatic alteration.

If the usual basic standards of 60 deg. F. and 30 in. pressure are adopted in the gauge calculations, then a change in temperature in T_n affects the volume:—

$$V_n = V \text{ (gauge reading)} \times \sqrt{\frac{460 + 60°F}{460 + T_n°F}}$$

This reveals that a change of temperature from 60 deg. F. to say 80 deg. F. affects the volume by

$$\sqrt{\frac{520}{540}} = 98\%$$

and a reliable general rule is 1 per cent. change in volume (gauge) per 10 deg. F.

Similarly a change in pressure (absolute) from 30 in. to 29 in. Hg affects the volume of

$$\sqrt{\frac{29}{30}} = 98\%$$

and the general rate of change around this pressure is approximately 1 per cent. per ½ in. Hg.

From these figures it becomes evident that nominal changes of pressure and temperature as experienced in this country are not likely to affect the gauge reading by more than 2 per cent. or 3 per cent. This is an important feature because it means that, bearing in mind the other possible variants, i.e., conditions of the coke, the cupola bore, tuyere areas, etc., it is commercially practical to accept the gauge reading as correct without making corrections for pressure and temperature variations.

A condition of much greater importance than atmospheric variations is that the volume reading should be made with the utmost precision, and that the differential device is not subject to variable influences due to proximity to the control valve, etc. The above adjustment of the pressure and temperature corrections must also be borne in mind in calculating the correction for atmospheric humidity.

Yours, etc.,

H. A. HALLETT.

196, Grove Lane, Smethwick, 40, Staffs.
August 11, 1942.

"A Works Visit"

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—I have read with great interest your Leader entitled "A Works Visit," dated August 6, but cannot agree that the picture is gloomy. There are a number of foundries who are prepared to work to the requirements laid down by your friend.

But I wish to draw your attention to the rather casual recommendation to every foundry "to have an X-ray apparatus and unceasingly apply remedies to the faults disclosed." You have yourself, Sir, on several occasions emphasised that the use of an X-ray apparatus is an expert's job and not one lightly to be undertaken. The members of the medical profession after many years experience of X-ray diagnosis frequently disagree among themselves. There is no reason to suppose that we foundrymen will immediately succeed where others have failed.

To maintain quality, rigid inspection is necessary, and for this precision instruments are required. The rule, the saw, fracture, machining, etc., may be called precision instruments in this sense.

Although X-ray examination is used to a limited extent in the light alloy section of the industry, it is not yet sufficiently developed to be placed in the hands of an inspector for the routine inspection of the heavier metals. When it is developed to this extent, all enlightened foundrymen will insist on its use on their own products.

Perhaps the Institute of British Foundrymen might usefully devote itself to this development?

Yours, etc.,

C. H. KAIN.

Braintree, Essex.
August 13, 1942.

[In giving the views of a prominent works manager, we did not necessarily subscribe to his notions. Mr. Kain is correct in pointing out that we are most insistent that in its present state of development X-ray testing is not suitable as an acceptance test.—THE EDITOR.]

(*Continued on page* 391.)

NON-BAUXITE ALUMINIUM

A QUESTION OF ECONOMICS

The war has again directed attention to the possibility of extracting aluminium from sources other than bauxite, the only commercially-practical aluminium ore. There are several hundred patents on different processes of obtaining aluminium from sources other than bauxite, but they would be so costly that the metal could not be economically marketed. It is obvious, therefore, that other sources of aluminium have never been used when bauxite has been available.

There are a few countries, including Germany, Japan, Norway and Canada, in which little or no bauxite occurs, and in some of these countries efforts have been made to use other aluminium-bearing materials of lower grade and those in which aluminium occurs in other forms than the hydrated oxide, such as silicate or sulphate. In Germany much experimental work has been done in an effort to use aluminium silicate rocks such as clays and phonolite as a source of aluminium, and shortly before the outbreak of the present war some pilot plants were built to continue the research on a small plant scale.

In Japan an aluminium industry was started eight or ten years ago using alunite, a basic potassium and aluminium sulphate, as raw material for aluminium production. Later high alumina clays found in North China and Manchuria were also used. With the development of the bauxite mines in Netherlands India, Japan found a more suitable source of raw materials for aluminium production and the use of alunite and high aluminium clays was discontinued.

Russia, through intensive research, has developed a fair supply of rather low-grade bauxite in recent years. Because of the long distance of the bauxite mines from some of the established aluminium plants, attempts to find more conveniently located raw materials have resulted in a limited use of nephelite, an alkali aluminium silicate.

Italy, although she has a modest supply of bauxite, has also very large areas of volcanic rocks rich in leucite, a potassium-aluminium silicate. Numerous experiments have been made to use leucite as a source of aluminium but thus far without success as the mineral cannot compete with bauxite, which is still readily available in Italy. The use of leucite, therefore, up to the present has been confined to the production of potash fertiliser and chemicals.

In Norway, where no bauxite occurs, the use of labradorite, an aluminium silicate for aluminium manufacture has recently been discussed. In Sweden the use of andalusite, another aluminium silicate, has been mentioned.

North America has a limited supply of high-grade bauxite and a somewhat more abundant supply of low-grade bauxite. In spite of readily available supplies of bauxite, however, technicians have for many years pursued investigations in connection with the use of aluminium-bearing materials other than bauxite for the production of the metal. Laboratory experiments and pilot plant operations on such materials as bauxitic clay and alunite have been conducted in the United States over many years. In Canada also aluminium silicate rocks have been under investigation for a decade or more.

No serious attempts, however, to use low-grade materials commercially have been made either in the United States or Canada as the processes for their utilisation are complicated and expensive and as it is recognised that none of the low-grade aluminous materials can compete with bauxite as long as the latter is available. No bauxite has been discovered in Canada. Other aluminium-bearing materials, however, including clays and shales as well as igneous rocks such as anorthosite and nepheline syenite are extremely abundant. Shales containing 20 to 25 per cent. or more aluminium oxide underlie vast tracts in the Prairie Provinces. Nepheline syenite, containing 25 to 30 per cent. aluminium oxide is found in many parts of Central Canada, whereas anorthosite, consisting largely of the mineral labradorite and containing approximately 30 per cent. aluminium oxide, is one of the most abundant rocks in the pre-Cambrian shield.—"Canadian Mining Journal."

CORRESPONDENCE.

(*Continued from p.* 390.)

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Your interesting article entitled "A Works Visit," which appeared on August 6, could hardly be passed without comment; may I express my views?

The statement that "dimensional accuracy still needs attention" is true, but how is that "attention" to be effectively applied? The average foundryman is not interested in the limits of accuracy implied by your article, he is hardly competent to check his equipment and find out "why?" when things are wrong.

May I suggest there is scope here for the employment of men of first rate ability (there is no use here for others) who have received their training in the pattern shop, and further, that the industry determine to pay these men first class salaries; after all, the industry has apparently reached a stage when it is necessary to "call in a specialist" in order to save its life.

I would question the statement that "Service technicians rule out without discussion the suitability of castings." When I consider some of the bright specimens "designed" (what a word) by some Government departments, I wish your statement were 100 per cent. true. I do not doubt the sincerity of your intention, which I interpret as follows:—"That Service technicians rule out without discussion the suitability of castings when it is obvious to a tradesman that a casting would do the job."

Yours, etc.,

A. H. SQUIRE.

22, Darnick Road, Sutton Coldfield,
Warwickshire.
August 14, 1942.

WASTE PAPER MUST NOT BE WASTED

American Metallurgical Scene—9

1941 MINERAL PRODUCTION

The value of mineral products in the United States last year—estimated at $6,600,000,000 by the Bureau of Mines—increased 18 per cent. over 1940 and reached its highest in history with the exception of 1920. National defence requirements, lend-lease activities, and wartime efforts of the United Nations all stimulated the peak demands for mineral products in 1941. Many mineral products, such as aluminium (300,000 tons, 50 per cent. over 1940), magnesium, zinc, iron ore, natural gasoline, petroleum, and coke, were produced last year in record quantities; other important mineral products, including coal, copper and manganese ore, showed increases over the preceding year ranging from 4 to 89 per cent. In addition, there was a substantial advance last year in shipments of iron ore, cement, and crude gypsum. The Bureau's estimated total value of all mineral products in 1941 is expected to be surpassed in 1942 owing to higher prices and the accelerated demands upon industry for war material, particularly those requiring increasingly greater amounts of steel, coal, petroleum, and some of the strategic minerals. The estimated value of metallic products in 1941 was $1,970,000,000, or 17 per cent. above 1940, and the highest on record except for the war years of 1917-1918.

The estimated value of mineral fuels in 1941 was $3,630,000,000, or 18 per cent. above the 1940 figure. The greatly increased tempo of industrial activity under wartime conditions had a marked effect on the bituminous coal industry in 1941. According to preliminary figures of the Bituminous Coal Division, United States Department of the Interior, 502,860,000 short tons were produced, an increase of 11 per cent. over 1940, and the largest production since 1929. Production of Pennsylvania anthracite in 1941 reversed in trend (it had been downward with few exceptions for two decades) and totalled 54,351,000 short tons, a 6 per cent. increase compared with 1940, according to preliminary figures. Increased activity in the heavy industries had a pronounced effect on the coke industry of the country. Preliminary figures for the output of by-product and beehive coke indicated a total of 64,678,800 short tons, which exceeds the previous record production attained in 1929 by nearly 5,000,000 tons. The increase in production over 1940 amounted to 7,607,000 tons or 13 per cent. Production from by-product plants amounted to 58,327,000 tons and that from beehive ovens 6,351,800 tons. New construction in the by-product coke industry added nearly 3,000,000 tons of capacity during 1941.

RAW-MATERIALS CONSUMPTION OF STEEL INDUSTRY

Almost 227,000,000 tons of raw materials were charged into American blast furnaces and steel furnaces during 1941, according to the American Iron and Steel Institute. In the production of 55,101,000 tons of pig-iron, a total of 172,300,000 tons of raw materials was consumed (94,600,000 tons of ore, 48,000,000 tons of coke, and 19,900,000 tons of limestone). In addition, 2,100,000 tons of scrap were charged into the blast furnaces, along with 7,700,000 tons of cinder and mill scale. Nearly 47,400,000 tons, or over 85 per cent. of the pig-iron produced in the industry's blast furnaces last year were charged into steel furnaces as a steel-making material. A total of nearly 42,000,000 tons of scrap iron and steel was consumed in the steel furnaces, along with approximately 5,000,000 tons of iron ore and 6,700,000 tons of fluxes, chiefly limestone. In addition, over 600,000 tons of iron in the form of cinder, mill scale and sinter were used.

Idle Iron Foundries.—According to Pittsburgh reports, various factors, such as the difficulty some plants are meeting in converting to war production and the fact that the majority of castings for war purposes seems to be specified in steel, have created considerable idle productive capacity among American iron foundries. Large manufacturers of radiators, bathtubs and the like are thinking in terms of post-war requirements for their products, while at the same time endeavouring to fit their capacity and personnel into the war pattern. This problem may lead to the creation of a Government staff of cast-iron products experts to seek essential channels through which the present idle foundry capacity and labour could be put to use for essential production. The problem of converting large radiator and enamelware plants to jobbing foundry activity is complicated by the fact that workers in these plants are machine moulders and generally could not qualify overnight for jobbing foundry requirements.

Use of Cobalt for Enamelling—Cobalt nickel oxide may be used in the manufacture of ground coat frit in America under an Order of the Director of Industry Operations. Consumption of cobalt in the manufacture of ground coat frit was limited, in any one quarter, to 35 per cent. of the amount of cobalt used in the first six months of 1941. The new Order permits use of cobalt nickel oxide which cannot be practicably separated into cobalt and nickel, and at the same time prohibits use of cobalt or compounds which can be so separated. There are now no restrictions on the sale or use of ground coat frit containing cobalt in commercially non-recoverable form.

Good Use of Pianos?—The President of the American Piano Manufacturers' Association estimates that 250,000 short tons of metal is hidden in 2,800,000 obsolete pianos stored in America. He urges everyone to co-operate with the salvage organisations in turning this metal reserve into war production. A modern piano contains an average of 160 lbs. of cast iron, 3.6 lbs. of brass, 5.5 lbs. of copper wire and 40 lbs. of steel. Older pianos are bulkier and would yield much more.

PRODUCTION OF UNIFORM STEEL FOR A LIGHT CASTINGS FOUNDRY

Report of Discussion at Annual Conference of Institute of British Foundrymen in London on June 20

By C. H. KAIN and L. W. SANDERS

Following the presentation of the Paper on the "Production of Uniform Steel for a Light Castings Foundry," by C. H. Kain and L. W. Sanders at the Ferrous Session of the Annual Conference of the Institute of British Foundrymen in London on June 20 last, the chairman, Mr. D. Sharp, opened the Paper for discussion, a report of which is given below. The Paper was reprinted in our issue of July 23 last.

MR. A. G. ROBIETTE congratulated the authors, particularly on the first part of the Paper, which described extremely good practice with rather obsolete equipment. The time cycles operated in American and modern British practice were nearly half the time cycles given in this Paper. Taking the figures given in Table III, he said that in American as well as in modern British practice the charging and melting with the electric furnace could be done within an hour, and the total time was about 2¼ hours instead of four hours as stated in the Table. The effect on the power consumption was that in a 50-cwt. furnace, top charged, the power required was from 680 to 700 units per liquid ton, which meant a saving of 160 or 170 units as compared with the authors' practice. Nothing was said in the Paper about the life of refractories which was generally worse in rapid melting furnaces, but there was a considerable saving in labour costs.

MR. KAIN said the electric furnace equipment in use was admittedly obsolete and it was not claimed that its practice was economical from the modern point of view. The whole object had been to achieve standardisation. The all-important object was to obtain the steel at stated intervals with clockwork regularity, so that at 2 a.m., 6 a.m., and 10 a.m. on, say, Friday there would be 47 cwts. of steel still available to go into the mould. They just had to use the tools which were there. It was interesting to hear that the complete cycle could be reduced to as little as 2¼ hours, and he had to confess that that was rather a surprise to him. The figures of power-consumption mentioned, *viz.*, 680 to 700, did not compare over-favourably with the unit consumption in his case of 860 per long ton, because the latter included coke charges and everything else. This figure was taken over a period of 12 months and represented the total power consumption divided by the total steel made, and included all losses during the year. Did Mr. Robiette's figure relate to long or short tons?

Reference to refractory life had been purposely omitted from the Paper because it was a subject of fairly considerable discussion at the moment. The walls of his furnaces were built of silica brick and the life was about 150 heats, which, under the conditions, was very much better than was commonly obtained 6 or 8 years ago. The dolomite consumption for the hearth was 43 lbs. per ton, including the dolomite which was rammed into the hearth and also the dolomite used for fettling. The dolomite used in the hearth was 3 lbs., and the 40 lbs. represented the amount used in fettling after each heat. In other words, the consumption of refractories in repairing the hearth was very much higher than the amount of basic material originally in the bottom.

A Plea for More Science

MR. J. J. SHEEHAN, who said he was interested in converter steel, remarked that up to now the making of steel had been considered an art but the authors had made an effort to convert it from an art to a science. There were, however, certain deficiencies in the Paper, particularly as, in some respects, it still hankered after the art of making steel. In his view there was no art in it to-day. It was definitely a scientific process and should be considered as such. One could see the hankering after the art, particularly in the reference to the blowing. The authors started with a pressure of 4 lbs. and gradually reduced it, for some obscure reason, to 2 lbs. In his view it was possible to produce steel with a constant pressure of 2½ lbs.

Again, there was no reference to the amount of air that was being put in. There was some reference to the pressure and the shape of the flame but too much was left to the judgment of the colour of the flame. Therefore, whilst he regarded the Paper as an effort to take steelmaking from the art stage to the scientific stage, unfortunately the authors had not gone far enough.

There was the question of the amount of air put into a particular mass and the time it took. He agreed entirely with the amount of carbon and silicon the authors had in the composition of their iron, but he did not see the necessity for the addition of any hematite. Although that was very valuable, the authors used 75 per cent. of steel and there was no reason why there should not be 100 per cent. of steel in the charge. There would be considerable economy, especially having regard to hematite iron being in short supply. Therefore, he would like some information as to why the authors used hematite, and also as to the amount of air that was put in after starting to blow at 4 lbs. per sq. in. and gradually dropping to 2 lbs. Why not carry on all the time at a constant pressure of 2½ or 2 lbs.? Further, why had the authors adopted batch melting in the cupola? Why not have continuous melting? There was no reason why there should not be the same charge every day from week to week throughout the year.

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Reason for Blast Pressure Reduction

MR. KAIN replied that greatly as he admired Mr. Sheehan's publications on technical subjects, it seemed that on this occasion Mr. Sheehan had not read the Paper with his usual care. Personally he made no attempt to defend steelmaking as an art. Indeed, this Paper was definitely an effort to reduce it to a precision operation. His constant argument with operators in the foundry was that steelmaking, like the mould, etc., was part of the production cycle and must be treated as such. He disclaimed any attempt to retain the "arty" aspect of steelmaking, which he agreed with Mr. Sheehan should be killed.

The blast pressure was reduced from 4 lbs. to 3 lbs.—not to 2 lbs., as stated by Mr. Sheehan—because with the size of vessel being used and the depth of the bath it was found that if the blast was maintained at full pressure there was excessive slopping and projection of the slag through the nose without any increase in the speed of production. It was impossible to reduce the pressure below 3 lbs. because the slag would run back into the tuyere. It was reduced gradually and not suddenly for the reason given very clearly in the Paper. Any sudden alteration in the amount of air going into the vessel entailed an alteration in the flame. If the blast was maintained at maximum pressure on these vessels, which he rather imagined were short for the amount of steel they contained, there were losses from splashing from the vessel. These vessels had a rammed weight of 4½ tons and about 91 tons of steel were obtained from them during the week.

Actually, batch melting was not used in the cupola. Continuous melting was being used, but the cupola charges so adjusted that each charge to the converter consisted of a stated number of complete cupola charges. Owing to the gradual increase in the weight of the charge to the vessel, if the weight of the cupola charge was not varied there would come a time when part of a cupola charge was being taken away to the converter vessel. In that way there were irregularities in the composition. He did not think the practice was utterly bad. Blowing was on a constant coke ratio of 10 to 1 and converting time was between 20 and 22 mins. Precisely 16 heats were now blown complete in 8 hrs. from start to finish, which included all handling, etc., and only 10 mins. were lost for each heat for charging and subsequent removal from the vessel.

Tuyere Standardisation

Unfortunately there were no means available at the moment of obtaining accurate figures of the volume of air going into the vessel, and therefore they could not be given in the Paper. However, it was found to be very important that the tuyeres should be made very accurately. Perhaps that was obvious but very great importance was attached to the correct location of the tuyeres. To obtain this in the lining used, there had been made a very elaborate jig which ensured that the tuyeres were truly perpendicular to the axis of the vessel. That was one of the things done to remove the "arty" aspect, in as much as the operator was not allowed to put the tuyeres in and adjust them as he thought fit. They were put in to a definite gauge and the whole of the operations were so standardised that after the blast had been put on, the whole plant could be left for 9 min. Then the blast had to be reduced because of the intensity of the boil and the danger of slopping. Once the blast had been reduced, there was no more to do until the end of the blow and the operator could go away and return at the end of 19 min.

With regard to the use of hematite, when the present emergency started, the question of going to 100 per cent. steel scrap was seriously considered, using ferro-silicon to make up the composition of the charge. Having no great experience of all-steel scrap charges, he was not anxious, if he could avoid it, to do so, and after negotiations with the Control it was finally decided, in conjunction with them, to adhere to the old practice of 70 per cent. scrap and 30 per cent. hematite because they said it was more economical. If it were absolutely pressed upon him he would be quite prepared to attempt 100 per cent. steel, but his experience a few years ago led him to be rather nervous about it because there had been considerable trouble with cupola wear and cupola erosion and also in disposing of the large volume of slag which was produced with the 100 per cent. steel mix.

All Steel Charges

MR. J. J. SHEEHAN maintained there is absolutely no difficulty in using 100 per cent. steel mix. If there was no difficulty in using 75 per cent. steel mix then there should be no difficulty in going the other 25 per cent. The time of 22 min. for the blow, mentioned by Mr. Kain, he personally considered inefficient, and 12 min. was all that should be taken for the blowing of a 20- to 27-cwt. converter; certainly 12 to 15 min. should be sufficient. With 100 per cent. steel mix the silicon could be kept down and the silicon need not be more than 1 to 1.2 per cent. It was possible to reduce the time of blow in the converter and get the increased efficiency possible with a time of 12 min. as compared with 22 min. The authors had progressed but they had not progressed far enough. There was available a very large amount of steel scrap and it should be used continually, and not necessarily depend upon hematite. These remarks were not so much by way of criticism as by way of stimulation, for the authors had done so well that he would like them to do better.

MR. J. H. COOPER said, whilst admiring what Mr. Sheehan had said, he could not altogether agree with him as to the use of 100 per cent. steel scrap. It was possible but as a working proposition it was not economical. The whole point with the converter was to realise that the process was simply a question of oxidation and de-oxidation. The air, as it passed through the tuyeres, oxidised the metal it came in contact with and then, of course, there

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was burning of the metal which ignited the silicon and manganese and burned them out, the carbon being oxidised last. He had seen converters with a blowing time of 7 min. only, whilst for others 12 min. was allowed. Within the past week in a new plant, over six charges the blowing time was an average of 23 min., but in these cases the silicon was rather higher than Mr. Kain recommended, *viz.*, 1.5. Providing the bath underneath the tuyeres was not too deep, the blowing time could be reduced to 14 or 15 min.

Seventy-five Per Cent. Scrap Desirable

To get the best results, fluid metal was usually essential. Comparable results were not obtained by the addition of ferro-silicon. One Sheffield firm had been experimenting with 80, 90 and 100 per cent. steel scrap, but it was found that 70 to 80 per cent. gave the best results. He supported the Tropenas process because the metal kept liquid much longer than any other steel, and he was also an advocate of the Stock converter. If really good steel was to be obtained from the Tropenas process it was necessary to start with a pressure of 3 lbs. and drop down to 2 lbs., and, on occasion, when the vessel was not working well and there was a cold charge, the pressure could be reduced to 1 lb. Care must be taken that the metal in the converter did not boil like milk, as it might do, because the vessel was then so full that the metal would run out at the spout. There was much to be said for temperature control and his contention was that if metal with 100 per cent. steel scrap were melted in the cupola and then used in the converter, there was a very much quicker drop in temperature than when using correct composition of metal in the converter.

The ideal was to keep the silicon to about 1.5 or 1.6, and, in the case of small castings, it could sometimes be as much as 2 per cent. There were great advantages in carrying out short period tests, and in the FOUNDRY TRADE JOURNAL recently it was stated that Messrs. Alexander Baird had carried out blows in 7 or 8 min. with some 200 casts. Other cases were known in which the blowing time was 35 min., thus there was a great difference exhibited. If available he would use hematite up to about 80 per cent. Steel scrap often was unsuitable. It arrived at the works in a rusty condition and involved losses in various directions. Ferro-silicon in the cupola did not always give good results because of the slag produced.

Production Doubled

MR. J. W. GARDOM added his appreciation to the authors for what he termed an exhilarating Paper, and said the particular point which occurred to him was that the authors stated that the time taken to melt a charge of 45 to 47 cwts., from the cold, was usually 2 hrs., but in another part of the Paper they spoke of a charge from the electric furnace coming down in over 4 hrs. It had been stated that the authors' plant was out of date, but surely nobody could imagine the authors were not aware of what was taking place in other parts of the country. Nobody could think the authors were so tied to their own works not to realise that they were working on perhaps obsolete plant, but what speakers seemed to have missed completely was the fact, as stated by Mr. Kain in introducing the Paper, that the output for which the plant was originally designed had been doubled. A great deal was said from time to time about post-war conditions, but no account seemed to be taken of improving the facilities now available and making the most of existing plants. The authors had a certain plant available, and by their methods they had doubled the output from it, which was the all-important point. Nobody could blame the authors for the plant they had, but if outputs could be doubled in a similar manner elsewhere, it would be a great contribution to the war effort. Although he himself had been responsible for spending large sums of money in this country on the erection of new plants, he felt much of the money would have been far better spent encouraging men like the authors to increase the output of their existing plants.

The CHAIRMAN (Mr. D. Sharpe) thanked Mr. Gardom for bringing out this point. It was very clearly stated by the authors that their object was to make the best use of the plant they had and to set a time table which would ensure the steel being ready for casting. The details as to whether the cupola converter or the electric furnace were efficient did not quite enter into the subject matter of the Paper. It was a great credit to the authors' concern and their colleagues that they had been able to work out a programme which was as near a continuous casting programme as one could expect to get from a plant of an ancient type such as the authors had. Personally he happened to be one of those who had been presented with a very modern and up-to-date plant which was capable of doing a melt of 4 tons in an hour, but he could bring the lining out of that furnace in 10 mins. A lining could be put in during the week-end and steel be made again on the Monday. In present circumstances it was necessary to leave cost of linings out of account even though they were difficult to get. He wished to offer the authors his congratulations on what they had accomplished. He hoped others would endeavour to emulate what they had done and improve existing plant output in a similar manner instead of having to spend thousands of pounds on the erection of more modern plants.

MR. J. J. SHEEHAN pointed out that his criticism had not been of the authors' plant but that they had not worked it properly. He had had a foundry which produced 20 tons of steel castings on an average per week, but it had also been possible to produce a very great deal more in the same place by suitable arrangements, as a matter of interest up to 70 tons per week, and he felt the authors could have done a great deal better if they had used 100 per cent. steel scrap. Mr. Cooper had said it could not be done economically, but what had economics to do with it, at the present moment.

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Furnace Technique Queried

MR. J. F. GIST said that when he first read the Paper he was very interested, but when he looked at the date and found it was the year 1942, he formed the opinion that it was not representative of modern practice. Whilst he wished to be constructive and not destructive in his comments, he felt that the practice outlined by the authors was about 15 years behind the times, as far as electric steel practice was concerned.

At the same time, he agreed that the practice outlined by the authors was quite good for the plant which they had at their disposal. In that respect he also agreed with the sentiments expressed by Mr. Gardom, yet he was bound to say he had had experience of a similar type of furnace, and got his heats out in a very much shorter time than that the authors had mentioned. With Mr. Sheehan he agreed that a very much higher output could be obtained with this particular furnace. On the other hand, if the foundry floor could only take steel every four hours, then the onus was not on his electric furnace to produce it in a quicker time.

There were one or two questions with regard to melting down which he would like to mention, although he had not read the Paper very thoroughly. The authors melted first and then added iron ore to create a "boil" to oxidise out the impurities in the bath. He believed it was current practice, although he stood to be corrected, to make an addition of iron ore with the charge, and that addition was based upon the analysis of the charge, particularly the carbon content, so that as the melt proceeded the bath was slightly on the boil, and the impurities being oxidised out, so that when the bath of steel was melted, and the correct temperature was obtained, the composition of the steel was correct, and the bath ready for slagging. This method saved a considerable amount of time, and prevents the refractories being subject to the arc, and the resulting deleterious effect while the "boil" was taking place.

With regard to carburising by means of anthracite, the authors made an addition of 20 lbs. of anthracite duff, but he would like to know if they had had any experience of carburising by means of pig-iron instead of anthracite, and, if so, had they noticed any increase of fluidity in the resulting steel. The time taken to form a second slag was stated to be 25 mins. Although he was now running a very modern furnace in his foundry, he had also had experience of working an old furnace of the type detailed by the authors, and in both cases he had been able continuously to form a white falling slag within 10 mins. If it was not formed within 10 mins., some very pointed questions were asked. He would like the authors' opinion on this matter.

Controlled Tapping Conditions

With regard to the tapping of steel, it was his procedure with the modern furnace, after carrying out the necessary refining conditions and making the steel to the specification, to thicken up the slag considerably before tapping. The current being switched off when this was done, and the bath held for 3 or 4 mins. The effect of this was for the slag to cake, allowing slag-free steel to enter the ladle, the slag coming out after the last portion of steel. This might not seem very good practice, but he could assure him that he was producing very sound steel by that method, whereas previously there was a little trouble from inclusions in the steel which were not apparent under the microscope, but were seen as small blobs imbedded in the skin of the casting and in the draw holes underneath the feeding heads. These first appeared to be fused sand inclusions, but upon analysis they proved to contain a percentage of manganese silicate. By adopting the practice he had mentioned, he found this trouble was overcome.

Another point with regard to tapping temperature was that he had tried out spoon testing, but could not get consistent results. They seemed to vary considerably with the skill of the operator in taking the spoon samples, therefore he did not regard the results as at all reliable, and that method had been given up. His temperatures were now taken by immersing ¼ in. wrought iron rod in the bath of steel for 3 secs., or according to the tapping temperature required. When the amount of rod which is immersed in the bath is completely dissolved off after this time, the steel is considered to be at the correct temperature for tapping. On checking this temperature by means of an optical pyrometer on the stream of metal leaving the furnace, it was found that when the rod dissolved off in three seconds, it is equivalent to a tapping temperature of between 1,580 and 1,600 deg. C. By means of the rod test he found that it was possible consistently to tap out the steel within a variation either way of 10 deg. C.

The authors had a drop in temperature from tapping to pouring the first mould of 20 deg. C. It would be interesting to learn how this was ascertained, because his own experience, using the latest type of optical pyrometer, had been that it was extremely difficult to get anything less than a temperature drop of 60 deg. C. between tapping and pouring the first mould. He would like to know if he used a course of insulating bricks in his ladles.

MR. KAIN, remarking that many of the points mentioned in the discussion would be commented upon in a written reply, said he would go further into the question of the use of 100 per cent. steel scrap mentioned by Mr. Sheehan. As to the time of the blow, he was not interested in the period of 12 mins. because he could not handle the extra quantity of steel so obtained with the plant he was working. Therefore, the question of the reduction of the blowing time did not arise. One of the snags in many foundries was that they struggled all the morning to get the cupola and converter ready and had no steel at all, whilst in the afternoon there was a deluge of steel which was splashed all over the place in handling.

He could not agree with Mr. Cooper that converter steel kept longer than any other steel, if both were

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properly made. So far as he could see at the moment, provided the steel was well made, the difference in life, fluidity and keeping power was very little indeed. A year or two ago he published some data on this point taken over a period of six months, which showed quite conclusively that the actual keeping power of the steels was practically identical. He would not deal with all the matters of detail mentioned by Mr. Cooper, but the point of the Paper was the necessity for laying down standard conditions and then eliminating the small variables. The idea of having a flat back to the vessel instead of a curved surface in order that the vessel could be turned back so that the metal was lifted on to the bottom of the tuyeres, was one of the "arty" features he had endeavoured to eliminate.

Some very nice remarks had been made by Mr. Gardom. As regards the point that in one part of the Paper it was stated that there was a 2 hours melt, and in another part of the Paper 4 hours was mentioned, the longer period related to melting, refining and finishing.

Working to Schedule

In reply to Mr. Gist, he said it was possible to produce steel in a shorter time than stated in the Paper, and also in a longer time, but the aim had been to arrive at a standard time. If there was a variation in this respect there was difficulty in having the requisite number of moulds ready, and if the time was made shorter then there was also difficulty in disposing of the steel. The whole object was to have the required amount of steel available at the stated times. It was easy to accelerate output if plenty of power was available, which unfortunately was not so in his case, the amount of power available being limited. Mr. Gist was wrong in stating it was the common practice to mix the ore with the charge. It was not possible to control the quality of steel by having oxidising conditions during the melt. That was the whole secret of quality. It was fatal to have unknown oxidising conditions during the melt, and for that reason he melted down to a definite composition and had controlled oxidising conditions after the bath was melted. It was not possible to control the state of oxidisation of the bath during the melt, because as the melt proceeded the temperature was varying and things were rather out of control as far as oxidation was concerned. There was considerably more control if the ore was added after melting, and the control so obtained was essential to successful steel making. He was prepared to defend this at very great length and to produce data to substantiate it.

Minimising Slag Inclusions

The addition of anthracite was not so much for the purpose of carburisation as the removal of excessive oxide. The authors could make white slag in 10 mins., but they did not consider this desirable, as the conditions were not under control. As regards thickening the slag before tapping, Mr. Kain said that for some time he worked exactly to the practice Mr. Gist had outlined, and although the bulk of the slag was held back in that way, finally the conditions were those the authors had tried to avoid, as the last metal and slag ran together. He claimed that tapping from the tap hole produced normal steel freer from inclusions.

He suggested that the cause of the failure of Mr. Gist in regard to his fluidity tests was that he left it to the skill of the operator. The conditions under which the authors took their tests were those laid down by Sanders and not by the furnace operator, and under these conditions it was found that the Ruff test used in an oil sand mould at constant temperature gave very good results. The important point with regard to temperatures was that until there was a really reliable immersion pyrometer available it was not much use talking too definitely about temperature figures. The Schofield-Grace immersion pyrometer was being used with success in 10-ton furnaces, and he did not think the time was far distant when it would be possible to ascertain the actual temperature drop in the ladles. Then it would be seen whether the ladles were properly heated. Considerable research was being carried out on the cooling of liquid steel in ladles, and some results had been published by the Iron and Steel Institute earlier this year. In the case of electric steel a great deal of trouble was undertaken in order to ensure that the ladles were very thoroughly heated for a period of not less than 4 hrs., and in the case of converters 6 hrs., but if there were facilities for going to 8 hrs., results were very much better.

MR. GIST said the reason for adding the ore to the charge was because it had been found with the modern furnace there was considerable erosion of the linings due to refractories being subject to the longer high-voltage arc, and much loss of time in waiting for the boil to finish. However, the ore was not added in a haphazard manner, as Mr. Kain almost suggested, but was previously calculated according to the nature of the scrap charged and its carbon content.

The CHAIRMAN, closing the discussion, cordially thanked the authors of the Paper on behalf of the meeting.

ARMASTEEL—ITS MANUFACTURE, CONTROL AND APPLICATIONS

(*Continued from p.* 397.)

must have a coke which will meet rigid specifications.

Close control must be maintained at all times and any changes immediately relayed to the foundry. Sometimes minor changes in the coals used in the coal mix have a major influence on the properties of the metal. In order to maintain close control of the coke the management requires periodic reports from the coke ovens covering all important points in their operation and raw materials used. No changes are made without first advising the foundry. Chart II is a sample covering the coal and coke data furnished periodically to the metallurgical department.

(*To be continued.*)

THE MAINTENANCE OF OSRAM TUBES

The ever-growing use of fluorescent tubes for lighting in all kinds of industrial premises is significant of their efficiency and versatility. Although they are only a little over two years old many thousands are now helping to speed the war effort in factories the country over. A series of notes and tables has been prepared to facilitate the diagnosis and location of faults in fluorescent-tube installations.

Primarily, it is important to be able to recognise a tube that has reached the end of its useful life in the normal way. The most usual symptoms are:—(*a*) When first switched on there is a tendency for the tube to flicker "on" and "off"; (*b*) blackening of the tube at one or both ends; and (*c*) an apparent slowing down of the periodicity, giving cycle flicker comparable with a tube on a 25-cycle installation. Excessive brightness of the filament at one or both ends of the tube may, or may not, accompany these symptoms. Whenever a tube that has burnt for a period approximating to its normal life shows one or more of these symptoms, it is better replaced by a new tube.

The following notes indicate how to diagnose causes of premature failure and appropriate remedies to take.

Diagnosis of Failure from Tube Behaviour

The Tube Flickers On and Off.—This may be due to:—(1) Tube has run full life, or (2) faulty glow switch, tending to switch on and off (examination of the switch in such cases usually discloses that an excess glow persists when the tube is operating), or (3) faulty tube (N.B.—Low line voltage, low ambient temperature, or cold drafts may be contributing factors). In (1) and (3) replace tube, in (2) replace glow switch.

Tube has the Appearance of the Whole Light Column Moving, Usually in the Form of a Spiral.—This usually occurs only when the tube is new, and disappears after a short period of use. Switching the tube off and re-starting after a few seconds is often a cure. If the effect continues for a long period replace tube.

Apparent Slowing Down of the Cycle Flicker to 25-Cycle Periods.—Tube has probably run its full life. Replace tube.

The Tube does not Light Up when Switched On but Both Filaments are Alight.—Switch contacts have locked in the closed position. To remedy, replace switch; a temporary remedy may be to give the switch a tap, which may cause contacts to open.

Tube does not Light, and One Filament Only is Glowing.—Earth fault on switch or radio suppressor circuit. (May be a short inside the radio suppressor or an earth on the wiring.) To remedy, if earth not detectable on the wiring, replace radio suppressor unit.

When Tube is Switched On, Nothing Lights Up at all.—This may be due to: (1) Broken tube filament (can be detected by careful examination and if discovered tube must be replaced), or (2) glow switch failing to close (replace switch; if new switch also fails to close, examine the circuit with a test lamp for a break at any part), or (3) break in some part of the circuit (examine circuit with test lamp and repair any break).

Diagnosis from Performance of Glow Switch

Switch Contacts Lock in the Closed Position.—May be due to the shorting of the resistance in the radio suppressor unit. To remedy, replace the suppressor.

Glow Persists while Lamp is Burning.—May be due to low extinction voltage. To remedy, replace glow switch; if glow still persists with new switch, fault is probably in the tube which should be replaced.

Switch Electrodes Loose in Bulb.—May be caused by an earth in the switch lead. Check wiring and put in new switch.

Too Rapid Operation of Glow Switch—this will result in the lamp switching on and off as the filaments have no time to heat up.—May be due to faulty switch. Replace switch.

A circuit which is not functioning correctly should be immediately disconnected until such time as the defect can be corrected. If, however, it so happens that other circuits are operating through the same switch the tube should be removed from the faulty circuit and, if possible, the supply should be disconnected locally. Otherwise damage to sound components may be caused.

The location of defects can often be expedited by simply trying the starting switch and/or the tube from the defective circuit in an adjacent good circuit. But the wise engineer will not try a good tube in a circuit that is suspected of being faulty. It is important to check the supply voltage with that of the equipment being used and to make sure that the correct choke tappings are being used. Also ascertain that the choke is connected in the phase lead, as this tends to minimise the effects of an "earth" on any part of the circuit.

It is worth noting that as soon as a tube is alight, the starting switch associated with it is out of circuit and can, therefore, be temporarily removed and used for replacement or testing on an adjacent faulty circuit without affecting the operation of the tube from which it has been removed. Finally, it should be noted that fluorescent tubes, like other electric discharge lamps, may continue to give light beyond the period of usefulness, in which event they will soon become so inefficient that, in the user's own interests, they should be replaced.

To assist works' engineers in charge of Osram fluorescent tube installations still further, the G.E.C. has prepared a card on which much of the above information is given in more concise form and a log table is provided so that a complete record of each tube and subsequent replacements may be kept with a minimum of trouble. Copies of these cards can be supplied on request to the G.E.C. at Magnet House, Kingsway, London, W.C.2.

THE INTERNATIONAL HARVESTER COMPANY reports that 1,367,000 net tons of scrap metal was collected in three months from farms and small towns in an America-wide campaign sponsored by the company and conducted by its 8,500 farm-equipment dealers.

BRAINS TRUST QUERIES—II

A report of the answers given by the Foundry and Metallurgical Brains Trust to questions 3 to 6 at a Spring meeting of the London Branch of the Institute of British Foundrymen, at which the Branch-President (Mr. R. B. Templeton) acted as Question-Master, is given in this second instalment. The first instalment and the constitution of the Brains Trust were given in our issue of July 30.

Tellurium as a Chill-producer

Question 3.—American research workers state that tellurium is the most potent chill-producing element known to cast-iron metallurgy. Does the Brains Trust advocate experiments being made by the British foundry industry whilst the war is in progress? (From Mr. V. C. Faulkner.)

DR. DESCH expressed the view that such experiments should not be made. In the first place, tellurium would behave like sulphur; its chilling effect was simply that of sulphur in an exaggerated form. Secondly, tellurium oxidised very readily; tellurium oxide was an intense poison, and anyone working near it might be overcome very quickly.

DR. EVEREST added that the chilling effect of tellurium would be very difficult to control; it was extremely powerful.

MR. MCRAE SMITH did not think there was any need for extra research on the problem at the moment, but suggested that in the better times which it was hoped were not far distant there would be plenty of scope for that type of work. He agreed with Dr. Desch that tellurium might be very dangerous in foundries, and also that it was very critical in its effect; but he had in mind factors such as the sulphur chilling of road setts as those in the Liverpool Tunnel, and suggested that tellurium might provide the answer to that problem. His answer to the question was that experiments should be made by the British foundry industry, though not until after the war.

The QUESTION-MASTER (Mr. R. B. Templeton) felt that Dr. Desch had hit the nail on the head when he had said that tellurium was dangerous to use and its chilling effect was difficult to control. Having tried to use it in his own foundry, he was able to confirm that control was difficult, even though the amounts used normally were in the region of only 0.003 per cent. The question as to whether or not it was desirable to carry out experiments under present circumstances depended on the facilities at the disposal of the individual foundries; he imagined that few founders nowadays had the time or the facilities to indulge in the kind of experiment envisaged.

Question 4.—Can the Brains Trust confirm that the old-fashioned pug mill did break up the silica grains when milling moulding sand? (From Mr. V. C. Faulkner.)

MR. KAIN said that the old-fashioned pug mill did not break up the silica grains when milling moulding sands unless the mill was almost empty and the rolls were pounding around on the bottom of the pan. If there were a reasonable load of sand in the mill, the rollers would have to be excessively heavy, far heavier than those applied in almost any type of mill, to produce any appreciable crushing of the sand grains.

MR. LONGDEN agreed.

MR. MCRAE SMITH also agreed, and added that if the grains of sands had been crushed there would probably not have been any really good castings made in certain foundries.

Derivation of "Green Sand"

Question 5.—What is the derivation of the term "green sand," and why should the term "green" be applied to sand which is definitely not green from the point of view of colour? (From Mr. G. Mann.)

MR. LONGDEN said that the term "green" was applied to the sand because it was moist or damp.

MR. KAIN pointed to the analogy in the pottery industry, where the original clay crucibles were referred to as being "green" until they were dried.

DR. DESCH suggested that in both cases the use of the term "green" must have arisen from the analogy with wood; green wood contained moisture.

MR. MCRAE SMITH said he had always thought that that was the real explanation. But in a German foundry he had seen the men using sand which was actually green in colour. In view of the fact that some sands were green in colour, the application of the term "green" to sands which were moist was rather confusing.

MR. MURPHY asked whether there was a similar term used in a similar way in other languages. The implication of the term "green," as applied to sands, was that they were immature. There was such a term in the French language.

MR. FAULKNER said that this was the case also in German. He added that Dr. Werner, the President of the German foundrymen's association, had insisted that the first green-sand castings were made in sand which was actually green in colour. Furthermore, there were deposits of green coloured sands in Dorsetshire, and they were used in the foundries.

The QUESTION-MASTER (Mr. R. B. Templeton), who admitted he had been able to get advice on the matter, said he was told that clay moulds were used in the foundry industry in the Middle Ages. But the Dutch founders had discovered that sand could be used for non-ferrous work, and when they had come to this country at the time of the persecution they brought their art with them. The first sand deposits they had used were from the Aylesbury beds, and those sands were green in colour. Then the term "green" had come to be applied to any sands which were not baked or dried, but which were used in the natural state; the term had become generic just as a man was referred to as being "green" if he were undeveloped or unskilled, or as timber was referred to as "green" until it was seasoned.

DR. EVEREST commented that there was a good deal of scepticism about that explanation.

Brains Trust Queries—II

Effect of Using Plumbago Crucibles

Question 6.—Has the extended use of the plumbago crucible reacted unfavourably against the introduction of the best melting conditions into non-ferrous foundries? (From Mr. F. Hudson.)

MR. MURPHY replied in the negative. He wondered whether the thought behind the question was that oxidising conditions would have a particularly unfavourable effect on plumbago. In many foundries to-day the melting practice which was thought to be the best possible was not restricted by the fact that plumbago crucibles were used.

MR. MCRAE SMITH was rather inclined to agree with the questioner, though in a somewhat indirect manner. If oxidising atmospheres were used extensively in the melting of non-ferrous metals, the plumbago crucible would probably not have had such great popularity as it had enjoyed. If oxidising atmospheres had been made more popular, the crucible manufacturers would have looked around for an alternative material. It seemed to him that, in that indirect way, the almost universal use of plumbago crucibles had had some retarding effect on the changeover to highly oxidising atmospheres for melting non-ferrous metals.

MR. MURPHY said the temperatures used in melting the non-ferrous alloys were much lower than those at which rapid oxidation of graphite occurred. Definitely oxidising conditions were used in melting tin bronzes, for example; graphite crucibles were used for that work, and the life of the graphite crucibles in foundries using that method was not less than in foundries using reducing conditions.

MR. MCRAE SMITH agreed that the temperatures did not rise to the extreme.

The QUESTION-MASTER (Mr. R. B. Templeton) suggested that Mr. Hudson could not have derived much satisfaction from the answers given to his question, because two different answers had been given. He asked if Mr. Hudson were satisfied with those answers.

MR. HUDSON replied that he was not.

MR. MURPHY commented that one of the answers must be right.

MR. G. C. PEIRCE (Past Branch-President), responding to the Branch-President's invitation to those in the body of the hall to express their views, said he felt that the question might be answered partly by those having practical experience extending over a long period and who had been prepared to try anything that came on to the market. He could justly claim to be one of those, and his view was that the plumbago crucible held its position by virtue of its own superiority.

MR. MCRAE SMITH wondered whether Mr. Hudson had meant to ask whether the development of the design of furnaces had been retarded by the almost universal use of plumbago crucibles.

MR. HUDSON said it was well known to-day that the use of oxidising conditions for melting gave the best results so far as gunmetal was concerned. That was not new. Some 25 years ago some work was done to show that oxidising atmospheres were beneficial; yet nothing had been done about it until two or three years ago, so that the extended use of oxidising conditions was quite recent. He asked what was the reason for lack of development in the meantime. From that he switched to the fact that, when a founder bought a furnace suitable for non-ferrous melting, the furnace manufacturer installed it, demonstrated how it should be run, and used a reducing atmosphere. It was designed to give a reducing atmosphere, in order to secure the longest life from the crucibles; indeed, the manufacturer provided a burner in which an oxidising atmosphere could not be obtained. Mr. Hudson felt that the furnace had been designed from the point of view of the crucible, whereas the crucible should have been designed from the point of view of the furnace.

MR. MURPHY suggested that perhaps Mr. Hudson was too charitable in assuming that there was so rational an explanation. He thought the answer was merely that nobody had bothered about it. There were obtainable, however, without any trouble, furnaces having burners which would produce oxidising conditions.

MR. HUDSON agreed, but pointed out that such burners were not often installed, and he had felt that some advice from the Brains Trust might draw attention to the need.

MR. MURPHY said he felt the practical answer to the question was that one could to-day use graphite pots and that they would have a satisfactory life when oxidising conditions were used.

The QUESTION-MASTER suggested that the development of the carborundum crucible might have its effect.

MR. HUDSON agreed that that might be so.

[*Further instalments of Brains Trust Queries will appear in subsequent issues.*]

BELGIAN INDUSTRIAL REORGANISATION

Obviously inspired by the protagonists of the so-called "New Order," Belgian industry has been informed by technical and trade press that the future of industrial Europe depends on the mobilisation and closest collaboration of every branch of industry. On Belgium, whose industrial prosperity depends largely on an active import and export trade, the changed economic conditions in Europe will weigh very heavy and result in fundamental retrenchment in every industry. The difficulties associated with such retrenchment can best be overcome by a central direction, which would control the distribution of all raw materials and regulate production, it is claimed. A later article dealing with the need for accelerating industrial reorganisation points out that in addition to purely economic and industrial decrees, a more comprehensive organisation is required of scientific and technical studies aiming at a resuscitation of industrial activity. Moreover, new methods of production must in many cases take the place of older processes, another field for "centralised guidance."

SOME JAPANESE PROBLEMS OF THE FUTURE

Some German views of several of the problems which Japan, and particularly her heavy industries will have to face in the near future, consequent on her conquest of large territories in Eastern Asia and her plans for developing an East Asian Co-Prosperity Sphere, was expressed by Dr. J. W. Reichert in "Stahl und Eisen" of March 26. Before passing to the heavy industries, he points out that by the campaigns in the first four months after Pearl Harbour, Japanese domination has been extended to an area of nearly 8 million sq. km., or 3¼ million sq. miles, inhabited by between 400 and 450 million people, while Old Japan, excluding Formosa, Korea, Kwantung and south Sakhalin, covered an area of only 380,000 sq. km. (143,000 sq. miles), with a population of about 70 millions.

The first serious obstacle to the rapid and successful exploitation of the conquered territories, the author indicates, is the lack of intercommunication and transport facilities in the hinterlands. These facilities are, of course, adequate in the coastal regions, where they have been developed for decades by Europeans. But the greater part of the Chinese massif has only the most primitive forms of transport, and even good roads are absent in vast areas. If these areas are to be developed on modern industrial lines, or even defended against invading forces, roads must be built and a comprehensive system of intercommunication provided. One phase of the transport problem is sea communications between the widely-scattered parts of the new Japanese empire. To meet the enormous demands of the war at sea against the chief maritime nations of the world and to provide shipping for normal trade operations, Japan needs a merchant navy which must be several times greater than the one she now possesses. Her shipyards are working to capacity, but Dr. Reichert considers that it will take ten years before her present tonnage is even doubled.

Iron and Steel Industry

In 1934, the author made an analysis of the Japanese iron and steel industry and suggested that the supply of raw materials and the security of her communications with the Asian mainland, her industrial and economic mainstay, were the twin Achilles heels in Japanese plans for future hegemony in Eastern Asia, *i.e.*, in her ability to wage war successfully. He now sees the position in a different light with Japan standing astride a conquered empire, and suggests that industrially Japan is totally unprepared to shoulder the burden of exploiting it. Her inability to expand communications to the level needed, owing to the general backwardness of existing transport facilities and the absence of a large mercantile marine, has already been mentioned above. On the industrial side, the same picture appears, for the new Japanese empire cannot be exploited without a vast army of machines, and at the moment Japan is quite incapable of building these machines in the numbers required. The capacity of her iron and steel industry is still very limited and by no means equal to producing all the iron and steel required of it. In the last generation, Japan has done much in developing a metallurgical industry, but her current position does not compare with the high state of development attained in the older iron and steel producing countries.

No effort has been spared in the past to create a large iron and steel industry in Japan. First, many years ago, came the Godo plan, then in 1938 a five-year plan was drawn up to cover also the metallurgical industries of Manchuria and North China, and under which production was to be stepped up annually to 1941. A development company to exploit the iron ore and coal resources of Manchuria was formed, and has made good progress; the Krupp Rennverfahren was introduced at several works to make sponge iron from the low-grade ores available. Steady progress was made with these plans, and increasing outputs reported up to the entry of Japan into the war. Current coal and lignite output of greater Japan is around 100 million tons per annum, while iron ore output has risen year by year. Supplies of manganese ore are sufficient for the requirements of the industry, but, points out Dr. Reichert, pig-iron output of Japan, Korea, Manchuria and occupied China is at present by no means of such a volume that it can possibly satisfy the ever-growing demand from the vast area which has been conquered by Japanese arms. In short, military success has outstripped industrial capacity.

In recent years iron and steel requirements of the whole so-called East Asian Co-Prosperity Sphere have been much greater than the total output of Japan, and the deficit has been covered from Europe and the United States. In 1937, China, the Netherlands East Indies, the Philippines, Indo-China, Thailand and Manchuria, excluding Japan, imported 1,500,000 tons of iron and steel, but if extensive developments under Japanese ægis are to be undertaken current and future requirements will be much greater. The author considers that the present iron and steel industry in Eastern Asia is much too small to undertake extensive schemes of exploitation in the conquered areas.

Government Control

To provide a co-ordinated industrial basis for waging war and for future economic expansion, the Japanese government in 1941 formed the Nippon Tekko Toseikai to co-ordinate the whole of the iron and steel industries in Japan, Manchuria and northern China, these areas being regarded as the present industrial nucleus of the Japanese empire. The direction of the N.T.T. was placed in the hands of Hirao, a former minister and president of the Nippon Seitetsu K.K. (the Japanese steel trust), and of Kohiyama, an ex-president of the Showa Seiko K.K. (the Showa Steelworks in Manchuria). The board included government officials and leading metallurgists, including Prof. Honda, Dr. Saito and Dr. Kunichi Tawara. The functions of the N.T.T. embrace every facet of complete control of the Japanese iron and steel industry, *e.g.*, state planning of raw material supplies and distribution, expansion in iron and steel production, fixing of production quotas, control and

(*Continued on page* 402.)

A SAND RECOVERY SYSTEM

A recent issue of the "Iron Age" describes a system of cleaning excess sand off the sprues and gates of castings before the metal is remelted in cupolas, and a means of separating all miscellaneous iron from all waste sand. This plant is in operation at the foundry of Pontiac Motor Division of General Motors Corporation. The equipment consists of a sprue mill, a loading hoist, an apron conveyor, a belt conveyor, a waste sand elevator, and a dust collector.

This equipment will handle a mixture of sand and iron or straight loads of gates and sprues at the rate of about 30 tons per hr. Iron particles larger than 1 in. in diameter are dumped on an apron conveyor which returns them to the iron yard, underneath the charging crane. This iron is free and clean from all sand, due to the tumbling action of the sprue mill. The sand and small particles of iron pass through a screen at the end of the cylinder to a belt conveyor. This belt conveyor has a magnetic pulley which separates all magnetic material from the sand. The sand is delivered by bucket elevator to an overhead storage hopper, placed high enough so that a dump truck can be loaded from the discharge spout. Fine iron, so recovered, is carried by a small belt conveyor to the yard underneath the charging crane.

In connection with the tumbling mill there is a large fan and dust collector that removes the fine dust from waste materials. Such dust is collected in a wet collector. About 30 tons of sand a day are removed from the overhead hopper and returned to the foundry sand system. The remainder of it is hauled to the dump as waste. Since this system was put into operation, Pontiac has made a practice of putting all waste sand through the tumbler. As a result, it is saving about 15 to 18 tons of iron per day, formerly lost through faulty magnetic separations and in the form of sweepings on the floor.

SOME JAPANESE PROBLEMS

(*Concluded from page* 401.)

supervision of plant and producers, fixing sales conditions and prices, etc. The first object of the N.T.T. was stated to be the more extensive industrialisation of Japan, Manchuria and northern China.

Dr. Reichert twice states that the N.T.T. early this year opened an office in Berlin "in order to maintain connections with German industrial circles." His insistence on the industrial unpreparedness of Japan to exploit her new empire and his enumeration of the difficulties, coupled with his welcome to the new Berlin office, seem to imply that Japanese aggrandisement in East Asia has proceeded rather too quickly for German calculations, and to suggest that Japan could overcome her unpreparedness in the industrial and technical spheres by calling to her aid the riper experience of her more-industrialised partner in Europe.

PERSONAL

MR. T. MARKLAND, a past-president of the Lancashire Branch of the Institute of British Foundrymen, recently celebrated his 80th birthday.

MR. CECIL MCFETRICH, director and secretary of Bartram & Sons, Limited, the Sunderland shipbuilders, has been elected a member of Sunderland Town Council.

MR. H. H. MILLER has been appointed London branch manager of British Insulated Cables, Limited, in succession to Mr. H. J. Stone, who has become home sales manager.

PILOT-OFFICER CHARLES BRUCE MORTON, whose home is at Leven, has been awarded the D.F.C. for "great tenacity, endurance and courage," while captain of an aircraft which bombed Wilhelmshaven one night in July. Pilot-Officer Morton served his apprenticeship as an engineer with Henry Balfour & Company, Limited, Durie Foundry, Leven, and prior to joining the R.A.F. was travelling engineering representative for the firm in London.

MR. H. BELL THOMPSON this year celebrates his 50th year of association with Sternol, Limited, oil refiners and lubricant manufacturers, of which he is managing director. To mark his golden jubilee a presentation is being made to him by the company. Mr. Thompson joined Sterns, Limited (the parent company) as a junior in 1892, and became general manager and a director of the company. On the formation of Sternol, Limited, in 1928, he was appointed managing director, retaining his seat on the board of Sterns, Limited.

Wills

FRASER, JAMES, a director of the General Electric Company, Limited	£69,618
FAWBERT, J. V., a director of Matthew Swain, Limited, ironfounders, Manchester	£4,928
DICK, ROBERT, of Darlington, secretary and a director of Pease & Partners, Limited	£4,792

NEWS IN BRIEF

IRON GATES AND RAILINGS collected in the London civil defence region total 114,623 tons; only 15 per cent. of those scheduled for removal remain.

JAMES CARTLAND & SON, LIMITED, brassfounders, of Birmingham, are to repay their 60,000 £1 preferred shares by a part cash and scrip issue and return 5s. per share on each of the issued 22,000 £1 ordinary shares.

WHOLESALE PRICES IN JULY, as measured by the Board of Trade index number, showed no change compared with June, due to divergent movements for food and industrial materials. Food prices in July fell by 1.8 per cent., while those of industrial materials and manufactures rose by 0.9 per cent.

A MEETING of the London Local Section of the Institute of Metals will be held at the Junior Institution of Engineers, 39, Victoria Street, S.W.1, on Thursday, September 3, at 6 p.m., when Mr. E. Mills will give an address on "The Inspection and Manipulation of Strip Metal." This will be the last meeting of the 1941/2 Session.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

545,481 UDY, M. J. Compositions and methods for treating molten metals.

545,495 BLISS COMPANY, E. W. Metal-bending machines.

545,503 SHORTER PROCESS COMPANY, LIMITED (Linde Air Products Company). Apparatus for locally heat-treating the surface of a metal body.

545,522 KNOWLSON, R. F. Cast or moulded machine and like parts having wear-resisting qualities.

545,537 CARTLIDGE, A. E. Metal-shearing machines and the like.

545,569 MOND NICKEL COMPANY. Production of steel.

545,650 TILGHMAN'S PATENT SAND BLAST COMPANY, LIMITED, and ANKERS, R. T. Centrifugal sand-blasting machines.

545,691 UDY, M. J. Compositions suitable for use in the production of chromium alloys.

545,723 SOC. METALLURGICA ITALIANA, and GUARESCHI, P. Process for the purification of metallic manganese.

545,724 SOC. METALLURGICA ITALIANA, and GUARESCHI, P. Process for the production of metallic manganese and if desired pure manganese dioxide.

545,726 TRIGGS, W. W. (Carnegie-Illinois Steel Corporation). Methods of pickling metallic strips.

545,728 AMBROSE, J. H. Reverberatory furnace.

545,777 ELECTRIC FURNACE COMPANY, LIMITED, SPANSWICK, J. R., and KING, S. G. Electric arc furnaces.

545,787 GRENE, G. H. S., and WILD-BARFIELD ELECTRIC FURNACES, LIMITED. Progression of work through furnaces.

545,810 PARKER, A. LA R. Rod or pipe bending machines.

MOTHERWELL ROLL TURNERS' TONNAGE BONUS

The Industrial Court has awarded a standard tonnage for the purpose of the roll turners' tonnage bonus scheme at the Lanarkshire Steelworks, Motherwell, of 2,700, an increase from 2,300 tons. The award is operative from the beginning of the first pay period following August 13.

The Lanarkshire Steel Company, Limited, claimed a revision of the standard tonnage, contending that since 1935 large scale additions, alterations, and improvements had been made at the works which had materially altered the working conditions and facilities for output, and that in these circumstances the figure of 2,300 should be increased. The men's union opposed the claim, contending that in any consideration of the increase in output regard should be had to the change in the nature of the products of the rolling mills and the effect of the changes on output of the new plant installed.

OBITUARY

MR. CHARLES JOHN ROBINSON, a managing director of Thomas Robinson & Son, Limited, engineers and ironfounders, of Rochdale, died recently.

MR. WILLIAM HENRY CHATWIN, of Tipton, who was for many years chairman of Chatwins, Limited, ironfounders and grate manufacturers, of Tipton, has died in his 84th year.

MR. D. B. MCCALLUM, founder and managing director of D. B. McCallum & Son, Limited, engineers and ship repairers, of Cardiff, died recently. He established the business more than 60 years ago.

MR. ALEXANDER EDWARD STEPHEN, for many years associated with the Clyde shipbuilding firm of Alexander Stephen & Sons, Limited, died on August 18, in his 82nd year. Mr. Stephen was managing director of the firm until 1915, when he was appointed chairman, a post he filled until 1929, when he retired.

MR. JOHN JOSEPH RAWLINGS, who died recently at the age of 82, was the inventor of the "Rawlplug." Starting business in South Kensington as general engineers with his brother, W. R. Rawlings, in 1886, he became joint managing director with his brother when the firm was converted into a limited company in 1900 under title Rawlings Bros. He became chairman of the Rawlplug Company, Limited, which followed and he was also a director of the Sun Electrical Company, Limited.

UNION STEEL CORPORATION (OF SOUTH AFRICA)

Reporting a considerable increase in turnover in all departments of the Union Steel Corporation (of South Africa), Limited, Col. K. Rood, M.P. (chairman) stated at the annual meeting that for the first time in the history of the Corporation the despatches exceeded £2,000,000. This had been mainly due to the increased turnovers of copper products, drill steel and castings. At the Vaal works despatches of rolled steel sections, etc., showed a small increase, and deliveries of castings from the foundry were greater by 1,159 tons. Despatches of sections and wire from the Klip Works showed an increase of 587 tons.

CATALOGUES RECEIVED

Electric Cables.—A four-page illustrated leaflet received from British Insulated Cables, Limited, of Prescot, Lancashire, gives technical details of the construction, current carrying capacity and terminal arrangements of varnished cambric insulated cables for such purposes as shop wiring, transformer connections and the like. Another publication, No. NSB2, illustrates and describes a new type of tee box for indoor industrial power distribution. Its main uses are for feeding relatively large individual loads; subdistribution boards and bolting direct to distribution boards, control gear and similar equipment.

COMPANY NEWS

(Figures for previous year in brackets.)

Lancashire Dynamo & Crypto—Interim dividend of 5% (same).

Davis & Timmins—Interim dividend on the ordinary shares of 10% (same).

Consett Spanish Ore—Net profit to June 30, £2,048 (net loss £1,608); brought in, £1,988; forward, £4,036.

Thorn Electrical Industries—Profit for the year to March 31, £33,681 (£25,634); ordinary dividend of 20% (same); forward, £8,915.

Larmuth & Bulmer—Net profit, after tax, for the year to March 31, £3,566 (£3,024); final ordinary dividend of 7½%, making 10% (same); forward, £4,539 (£5,106).

George Kent—Profit to March 31, after tax, £75,611; ordinary dividend of 10%, plus a bonus of 2½%; to general reserve, £12,014; to special reserve, £2,104; forward, £40,667.

Engineering & Lighting Equipment—Net profit for the year to March 31, £23,006 (£18,468), after £9,250 (£39,500) for income-tax and E.P.T. reserves; final ordinary dividend of 6%, making 10% (same).

A. & J. Main—Net profit for 1941, after depreciation and taxation, £21,261 (£18,855); dividend of 6½% on the cumulative preference shares, £4,463; to general reserve, £10,000; dividend of 10% on the ordinary shares (same), £6,482; forward, £6,296 (£5,980).

James Howden & Company—Profit for the year to April 30, after interest charges, war damage insurance, etc., £80,998 (£80,053); taxation, £52,000 (£41,850); to general reserve, £10,000 (£20,000); dividend of 1s. 6d. per 10s. share (same); forward, £19,194 (£18,046).

Warner & Company—Trading profit for the year to June 30, £14,676 (£11,862); income from investments, £808; dividend on the 6% cumulative preference shares, £1,350; taxation, £10,249; depreciation, £1,850; dividend on the ordinary shares of 6% (5%); forward, £3,592 (£3,541).

Walker Bros.—Trading profit for the year to March 31, £30,633; fees, depreciation, interest on debenture stock, A.R.P. expenditure, etc., £7,626; net profit, subject to tax, £23,007; taxation, £11,981; dividend on the ordinary shares of 7% (same); special repairs and renewals, £5,000; war damage insurance, £1,000; debenture redemption, £1,725.

Davy & United Engineering Company—Net profit for the year to March 31, after providing for taxation, £52,538 (£51,659); dividend of 7½% (same), £23,531; directors' additional remuneration, £4,006; reduction of the value of the consideration for trading and manufacturing agreement with United Engineering & Foundry Company, £5,000 (same); forward, £139,261 (£119,260).

EXPORT PRICES FOR MACHINE TOOLS

Export prices for new machine tools produced in the United Kingdom came under control as from August 15 by an Order issued by the Minister of Supply.

The Order, the Control of Machine Tools (No. 12) Order, 1942, is obtainable from H.M. Stationery Office (price 1d.), or through any bookseller.

NEW TRADE MARKS

The following applications to register trade marks appear in the "Trade Marks Journal":—

"MUREX"—Metals and alloys. MUREX, LIMITED, Ferry Lane, Rainham, Essex.

"SCRIVET"—Bolts. HENRY LINDSAY, LIMITED, 47, Queen's Road, Bradford, Yorks.

"GYRONE"—Engines and motors. POWER JETS, LIMITED, Ladywood Works, Lutterworth, Leics.

"MYFORD"—Machine tools. MYFORD ENGINEERING COMPANY, LIMITED, Chilwell Road, Beeston, Notts.

"ELCOM"—Machine tools. B. ELLIOTT & COMPANY, LIMITED, Victoria Road, Willesden, London, N.W.10.

"BULL DOG"—Hand tools. ABINGDON WORKS (1931), LIMITED, King's Road, Tyseley, Birmingham, 11.

"MYFORD"—Machine tools. MYFORD ENGINEERING COMPANY, LIMITED, Chilwell Road, Beeston, Notts.

"DURACABLE"—Insulated electric cables. DURATUBE & WIRE, LIMITED, 16, Hanworth Road, Feltham, Middx.

"BELCO"—Reamers and chucks. B. ELLIOTT & COMPANY, LIMITED, Victoria Road, Willesden, London, N.W.10.

"QUEEN BEE" and Device—Hand tools, RICHARDS BROS. & SONS, LIMITED, 202, Broomhall Street, Sheffield.

"WORTLEX"—Electric motors, machine couplings and machine belting. WORTLEYS, 37, Leppings Lane, Sheffield, 6.

"FOTOWELD"—Chains and cables. PARSONS CHAIN COMPANY, LIMITED, Worcester Road, Stourport-on-Severn, Worcs.

"JONIL"—Iron castings. JOHN HILL & SONS (WOLVERHAMPTON), LIMITED, Albion Street, Horseley Fields, Wolverhampton.

"BRICOVMO"—Pistons, piston rings, sleeve valves and greasers. C.M.D. ENGINEERING COMPANY, LIMITED, Wharf Street, Warwick.

"MG 7"—Aluminium magnesium alloys. JAMES BOOTH & COMPANY (1915), LIMITED, Argyle Street, Nechells, Birmingham, 7.

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

Doidge Tool & Engineering Company, 177, Merton Road, London, S.W.19.—£1,000.

Days (Engineers), Broad Quay, Bristol, 1—£3,000. E. and E. G. Day and R. E. Packer.

Engineers (Rhondda)—£1,000. O. I. Davies, and J. G. Evans, 37, Mackintosh Road, Pontypridd, Glam.

Tyseley Engineering Company, 823, Warwick Road, Tyseley, Birmingham—£1,000. L. A. Sparling and T. A. C. Sparling.

Ladbrook Engineering & Manufacturing Company, 20-22, Beardall Street, London, S.E.19—£2,000. J. W. and M. M. Spinks.

Burrows, Green—Mill furnishers, engineers, etc. £10,000. F. W. Burrows, and A. Green, 8, Crawshaw Street, Colne, Lancs.

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PIG IRON

IS CHARACTERISED by closeness of grain structure, uniformity of composition and fine graphitic carbon evenly distributed.

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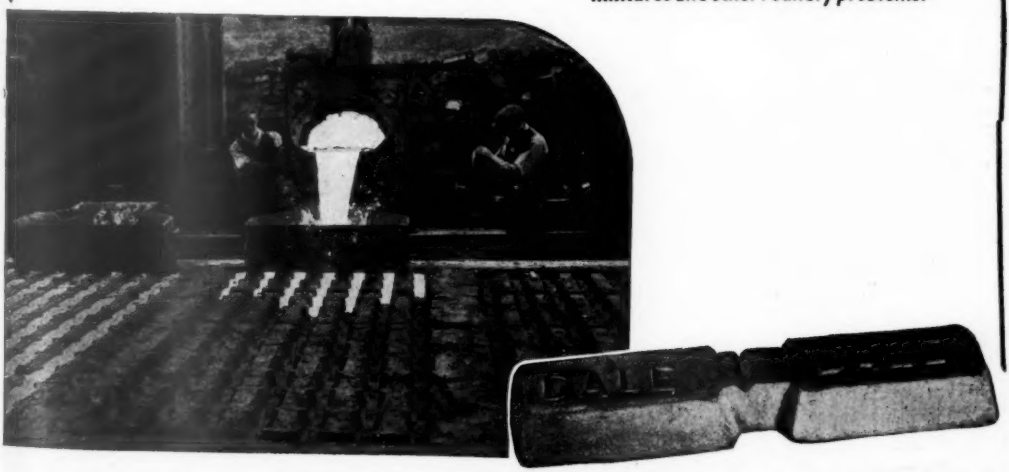
Users are invited to avail themselves of the Stanton Technical Service which offers free expert advice on special mixtures and other Foundry problems.



THE STANTON IRONWORKS COMPANY LIMITED, NEAR NOTTINGHAM

Raw Material Markets

IRON AND STEEL

Holidays at the iron and steel centres are now largely completed and producing units are again getting into their stride to meet the continuous pressure for supplies. The contraction in outputs due to holidays and to breaks for the carrying out of repairs and renewals has been appreciably less than in normal times, thanks to a ready appreciation on the part of the workers of the necessity for maintaining steady supplies to the war factories and to the policy of carrying out running repairs to plant in order to obviate any undue hold-up in operations. The influx of women labour into iron and steel works has been speeded up of late and the number of women now in employment in the industry is quite large and tending to expand. This revolutionary development in the staffing of the industry is, of course, due to the fact that many of the younger men have been drafted into the Forces, a process from which iron and steel manufacture, key industry though it is, has not been exempt.

Business on hand at the foundries varies according to the nature of their products. Demand for light castings is not sufficient to keep makers employed at their pre-war level in most instances, and many of these foundries have been included in the Government's plans for the concentration of industry.

Conditions in the heavy engineering branch remain very active, with a strong demand for castings from Government departments. These foundries have been kept in continuous employment since the outbreak of the war and there is every prospect of their being fully engaged over a long period to come, as their products are required for munitions, tank production, aircraft work and many other important purposes. Heavy engineers' raw material requirements are being readily satisfied in the main, the bulk of their needs being for medium- and low-phosphorus irons, refined iron and hematite. The latter is not at all easy to procure, but the authorities are prepared to release supplies when its use is really essential. Owing to the shortage of the better qualities of iron, heavy engineering works have been making use of quite large tonnages of high-phosphorus iron.

Steel production is maintained at recent high levels, and the demand, especially for the special and alloy grades, is developing the whole time. These qualities are being taken up by the munition and armament works as fast as they can be made available, and in recent months the output has been considerably enlarged. In other directions, structural steel is more active. Structural sections are in great request by the shipbuilding yards, which are also big consumers of steel plates. Sheet mills are very active. Cold-rolled strip and bright-drawn steel bars are being promptly absorbed by the engineering works.

NON-FERROUS METALS

All official requirements of copper continue to be readily satisfied. Distribution is very carefully controlled, but the necessity for economy is not being permitted to interfere with important uses. Productive capacity for brass billets is steadily developing, and the expansion noted in recent months is very gratifying.

The U.S. War Production Board has stated recently that the minimum tin requirements of the United States during the current year will be 65,000 tons. The statement added that this quantity will be supplied to the extent of 41,000 tons from the stockpile there, while 15,000 tons will come from Bolivian concentrates and 9,000 tons from the Belgian Congo.

Spelter continues to be needed in large tonnages for various uses in connection with the war effort. Supplies for these purposes are adequate, but the ordinary domestic consumer is still on short commons and will remain so while more urgent needs are on hand, as there is certainly no metal to spare in view of the reliance which the United Kingdom has to place on shipping for its supplies. Zinc and zinc alloys are used quite extensively in the manufacture of dies for forming sheet metal parts for aircraft construction, and the consumption of the metal in this direction is increasing at an appreciable rate.

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